Genetic Applications from National Parks

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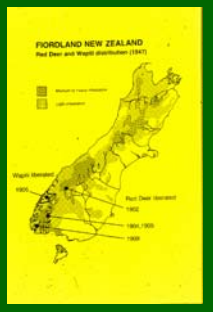
The example elk and red deer



Fiordland National Park, NZ

The genotype: allele frequencies for a single locus (Hemoglobin)

Haemoglobin genotypes (Hb)

	n	AA	AB	BB
Red deer	236	236	0	0
Canadian elk	48	0	0	48
F_1 hybrids	35	0	35	0
Fiordland wapiti	197	45	108	44

The genotype: allele frequencies for another locus (SOD)

Superoxide Dismutase genotypes (SOD)

	n	SS	SF	FF
Red deer	236	228	8	0
Canadian elk	48	2	11	35
F1 hybrids	35	1	34	0
Fiordland wapiti	197	63	92	42

Gene frequencies to trees

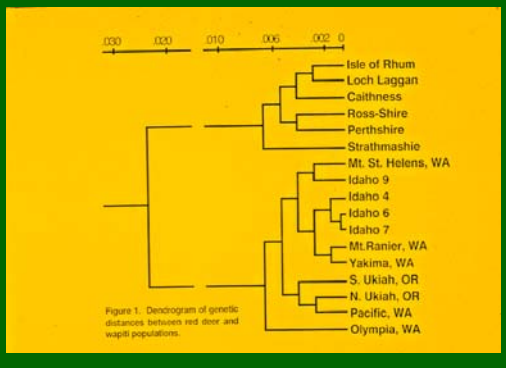
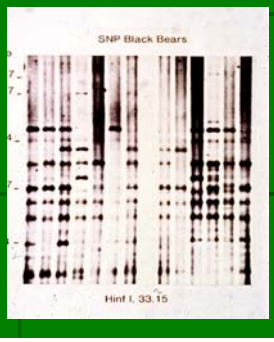


Figure 1. Dendrogram of genetic distances between red deer and wapiti populations.

DNA fingerprints in blacks bear Shenandoah National Park



Section 207 First Tests

Grizzly (*Ursus arctos*)

Goshawk (*Accipiter gentilis*)

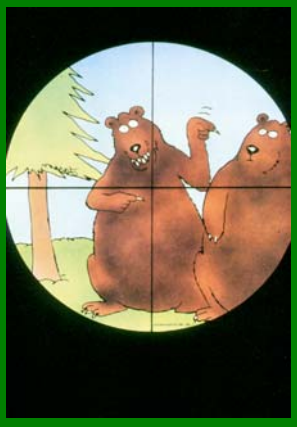
Section 207 NPOMA (1998)

FEDERAL RESTRICTIONS REGARDING RELEASE OF INFORMATION ABOUT THE SPECIFIC LOCATION OF SENSITIVE RESOURCES

Section 207 of the 1998 National Parks Omnibus Act includes legislative language protecting location information about certain resources from FOIA requests.

CONFIDENTIALITY OF INFORMATION.
Information concerning the nature and specific location of a National Park System resource which is endangered, threatened, rare, or commercially valuable, of mineral or paleontological objects within units of the National Park System, or of objects of cultural patrimony with units of the National Park System, may be withheld from the public in response to a request under section 552 of title 5 United States Code, unless the Secretary determines that--
(1) disclosure of the information would further the purposes of the unit of the National Park System in which the resource or object is located and would not create an unreasonable risk of harm, theft, or destruction of the resource or object, including individual organic or inorganic specimens; and
(2) disclosure is consistent with other applicable laws protecting the resource or object.

New selection pressures in grizzly bears with proposed delisting



California Condors

- Endangered in wild
- Captive breeding in zoos
- Restored to Grand Canyon NP and Pinnacles NP

Chondrodystrophy in Condors

- Lethal recessive that results in dwarf long bones: 5/169 chicks die around hatching.
- Normal homozygotes and heterozygotes are phenotypically not distinguishable.
- If $p^2 + 2(p)dw + dw^2 = 1$ and $dw^2 = .0294$ then what is the frequency of dw?
- Is this low or high? And why?

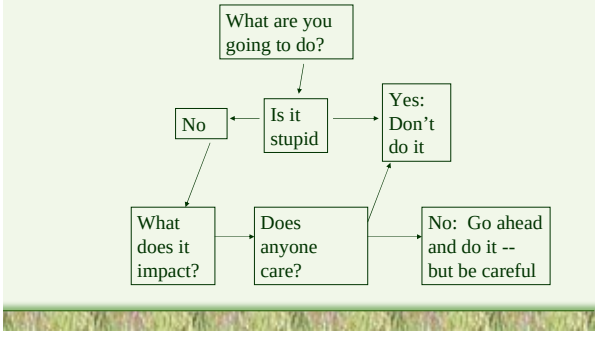
Genetic differences in Florida Panthers

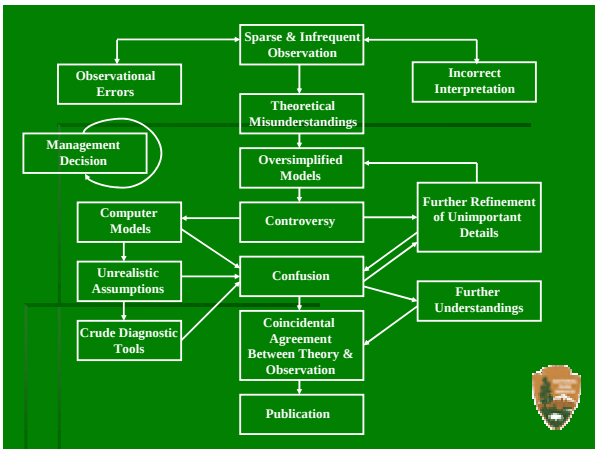
Subspecies	% polymorphic loci *P*	Allozyme Heterozygosity H_e	DNA fingerprint Heterozygosity
Florida panther	4.9	1.8	10.4
Western U.S. *Puma concolor*	9.9	4.3	46.9
Range in other cats	8-21	3-8	45.9 (Domestic cat)

From *Introduction to Conservation Genetics*, 2002

The case of the Florida Panther

NPS Consultation: *The Way We Were*



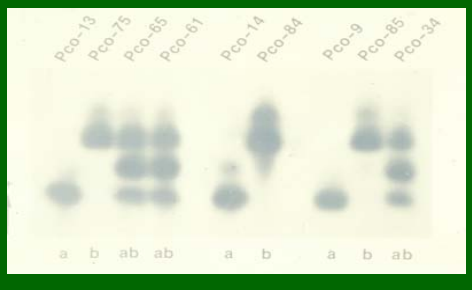


Relatedness of mating individuals and fitness reductions

- Inbreeding depression results from close relatedness.
  - loss of fitness (decreased viability and/or fecundity) with increasing homozygosity
- Outbreeding depression results from distant relatedness (evolutionary divergence).

Allozyme results: APRT locus

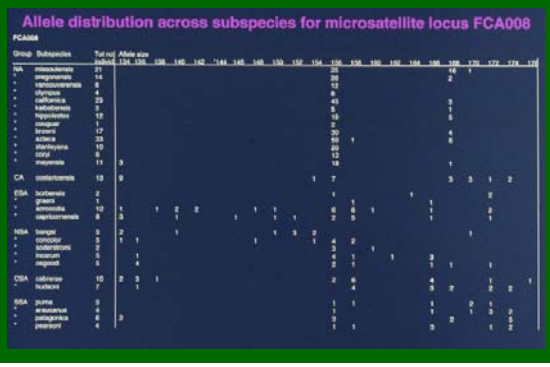
- Allele A only in Big Cypress National Preserve
- Alleles A and B in Everglades National Park



mtDNA Haplotypes:

- -Big Cypress has types A and B
- -Everglades has only type B
- -Types A and B are highly divergent
- -Types A,D,C in North America
- -Types B,E,F in South America (B is Panama)

Microsatellite alleles



Wright's Fst Estimates and Slatkin's Migration Estimates

mtDNA

	NA	CA	ESA	NSA	CSA	SSA
NA	-	0.1	0.1	0.02	0.03	0.1
CA	*0.784	-	8.3	0.5	1.6	1.6
ESA	*0.815	0.057	-	0.8	2.3	2.2
NSA	*0.958	*0.492	0.384	-	4.2	0.5
CSA	*0.935	0.233	*0.177	*0.107	-	1.3
SSA	*0.835	0.240	*0.186	*0.526	*0.281	-

microsatellites

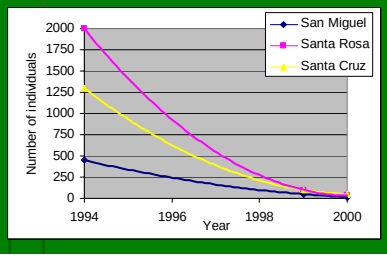
	NA	CA	ESA	NSA	CSA	SSA
NA	-	4.0	4.4	8.0	2.2	0.9
CA	*0.110	-	2.3	3.5	3.5	1.2
ESA	*0.103	*0.179	-	15.7	4.8	1.0
NSA	*0.059	*0.126	*0.031	-	6.0	1.1
CSA	*0.186	*0.126	*0.094	*0.077	-	2.4
SSA	*0.367	*0.288	*0.330	*0.316	*0.172	-

Channel Island Fox (*Urocyon littoralis*)

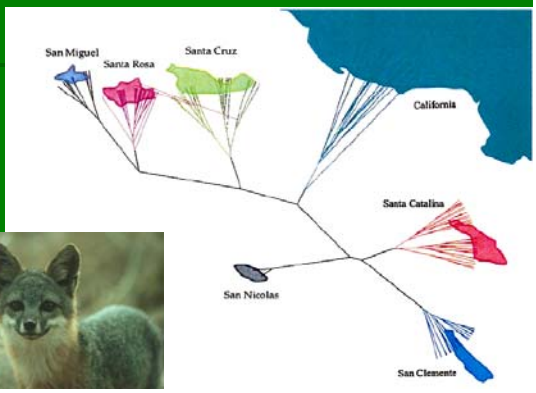
Population crash: Fox decline on the Northern Channel Islands

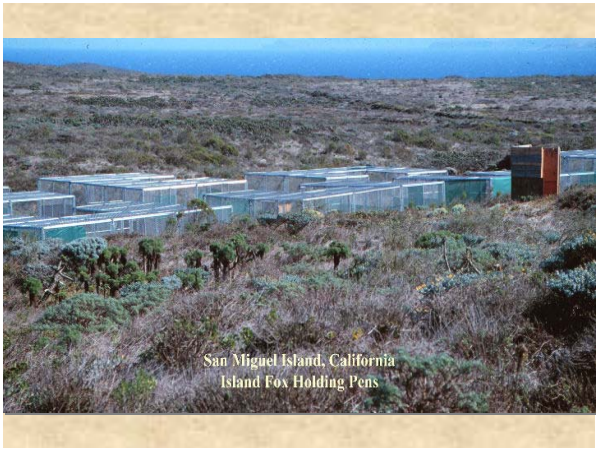
Northern Islands decline due to Golden Eagle predation

Golden Eagle



What islands are highest priority for conservation? Which populations should potentially be interbred?



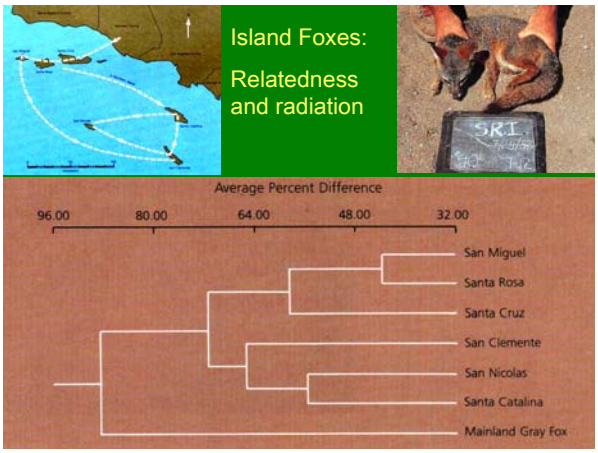


Major Histocompatability Complex (MHC)

- Multigene Family in Vertebrates
- Contains genes for cell surface glyco-proteins
  - Involved in antigen presentation to cell of the immune system
- Class I vs. Class II
  - I - present endogenous antigens
  - II - present exogenous antigens

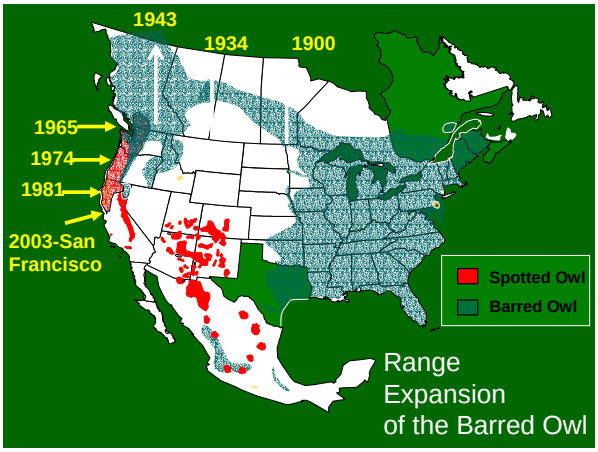
MHC vs. Microsatellites

Island	Microsatellites (9 loci)	FH2202	ULI-DRB
San Miguel	0.20(2.11)	0.75 (4)	0.00 (2)
Santa Rosa	0.26 (3.44)	0.69 (7)	0.15 (2)
Santa Cruz	0.27 (2.89)	0.42 (6)	0.15 (2)
San Nicolas	**0.00 (1)**	**0.43 (4)**	**0.36 (2)**
Santa Catalina	0.33 (3)	0.72 (7)	0.35 (3)
San Clemente	0.27 (2.67)	0.45 (5)	0.00 (1)

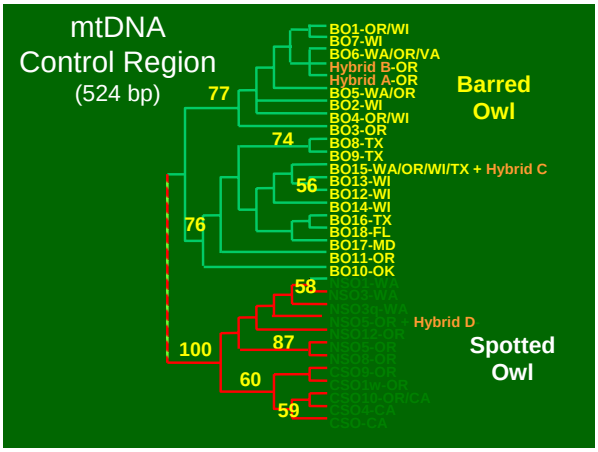


Identifying Owl Hybrids

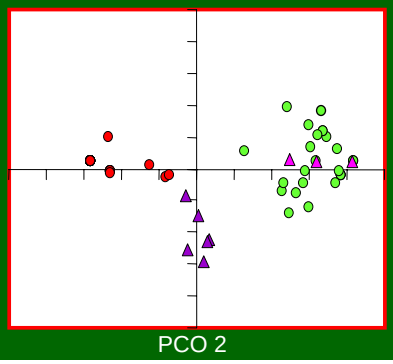
Susan Haig, et. al.
Conservation Biology (2004)



Sparred Owls?



AFLP analysis of spotted and barred owls and hybrids of these two species



Sources of genetic concern

Northern Spotted Owls (NSO):
- Current population fragmentation
- Mixing with CSO and Barred Owls

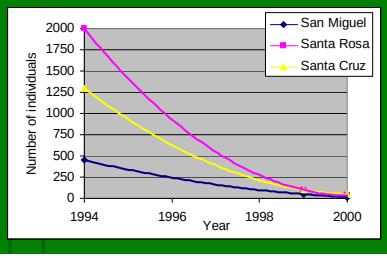
California Spotted Owls (CSO):
- Lack of genetic diversity in Southern CA
- Mixing with NSO and/or Barred Owls
- Not significantly different than MSO

Mexican Spotted Owls (MSO):
- Not significantly different than CSO.
- Extreme population fragmentation and low levels of gene flow.

Population crash: Fox decline on the Northern Channel Islands

Northern Islands decline due to Golden Eagle predation

Golden Eagle



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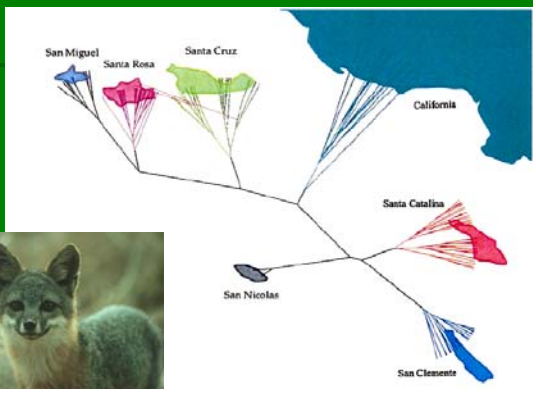
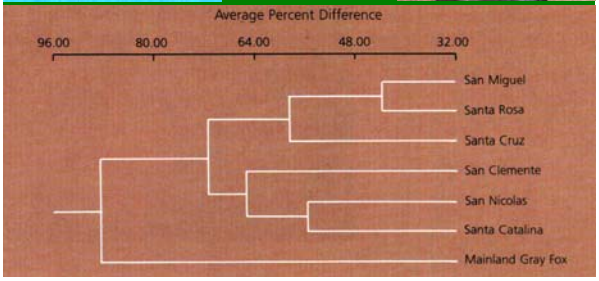


Island Foxes:

Relatedness and radiation



Thermus aquaticus Taq *in situ* in Yellowstone NP